First Operation.—It was apparent that an operation was imperative. Consequently the patient was sent to the operating room and no time was lost in opening the abdomen and exploring the gall bladder, which was found to be markedly distended, with walls considerably thickened. On account of the inflammatory adhesions between the gall bladder and the surrounding viscera some time was consumed in controlling the hemorrhage. This complication necessitated concluding the operation hurriedly as the patient was in a very weak condition. The gall bladder was opened in the ordinary way, no time being taken to explore the interior; and a large tube was inserted after the Mayo plan. The patient was then dressed and returned to her room in a fair condition.

Postoperative History.—She made a good recovery and continued in a good condition, the temperature and pulse being normal and the bowels moving every day for the following five days. Dr. Alice Hamilton, of the Memorial Institute for Infectious Diseases, Chicago, who is investigating the subject of typhoid carriers with special reference to the gall bladder infections, examined this patient on the fifth day after the operation and found the paratyphoid organism in pure culture in the blood. On the evening of the fifth day after the operation the patient had two chills with a rapid rise in temperature and pulse so that on the following morning she presented the picture of profound collapse. In this condition she remained until the evening of that day, during which time the abdomen gradually became markedly distended. Repeated attempts to move the bowels both by catharsis and enemas proved futile. At 6 o'clock that evening the patient seemed in a dying condition. Dr. Arthur A. Small was called in consultation and, after a hurried examination, approved the proposed procedure for the relief of the ileus. The clinical chart at this time showed the pulse to be 156 and the temperature 103.5. There was also stercoraceous vomiting. The patient was sent to the operating room and the operation was performed under cocain anesthesia. The patient had an uneventful recovery, save the irritation occasioned by the fecal material passing out on the abdomen.

TECHNIC OF THE OPERATION

The choice of an incision depends somewhat on the site of the incision of the original operation. Under most circumstances the first incision may be used for entrance into the abdomen, thus lessening the pain and the shock to the patient. The location of choice, however, is in the median line midway between the umbilicus and the symphysis pubis, for in this region a loop of the intestine near the lower end of the jejunum or the beginning of the ileum can be most readily picked up.

In other words, the operator attempts hurriedly to select a point in the small intestine approximately midway between the pyloric end of the stomach and the ileocecal valve. The distended loop of bowel is brought up through the abdominal wall and the distention reduced by stripping the intestine either way and applying a rubber-mounted intestinal clamp at the upper and lower angles of the wound, thereby collapsing the intervening portion of the bowel and reducing it to a condition so that sutures may be affixed without perforation.

Experience in handling these two cases has demonstrated, contrary to the teachings of many text-books on surgery, that but little gas escapes when the bowel is opened. Consequently great stress is placed on the introduction of long tubes into the intestine, as by this arrangement the irrigating solution performs a double rôle. First, the solution by entering the bowel at a considerable distance from the opening mechanically forces the gas and fecal matter to escape. Second, the introduction of the saline solution into this portion of the intestine with its rich supply of lymphatics acts as an immediate and powerful stimulant.

The after-treatment in such cases consists in sustaining the patient by rectal feeding for one week, at which time this feeding is supplemented by liquid diet by mouth, and this form of treatment is continued for a period of several weeks until the patient has regained sufficient strength to undergo an operation for the closure of the intestinal fistula. The feeding by mouth is discontinued for a week previous to the operation and the intestine carefully irrigated with an antiseptic solution.

The operation for the closure of the fistula consists in the resecting of five or six inches of the intestine and bringing the bowel together by means of a lateral anastomosis.

The treatment of paralytic ileus accompanying typhoid fever by this method has been suggested because of the parallelism of that disease and Case 2 in this paper. From the bacteriologic investigation of cholecystitis it would seem logical to conclude that the paratyphoid organism isolated from the blood of this patient by Dr. Hamilton may have remained latent in the gall bladder from the time of this patient's first attack until the date of this operation, at which time the disturbance set up in the gall bladder by the operation caused the organism to invade the blood, producing paratyphoid septicemia which in turn, just as in typhoid fever, may have been responsible for the paralyzed condition of the bowels in this case.

CONCLUSION

This mode of treatment, *per se,* is attended with grave danger and should be resorted to only after every effort by medicinal means has proven futile, but is apparently indicated in extreme cases in which death seems impending as sometimes occurs in the following conditions: (a) paralytic ileus following operations; (b) abdominal distention caused by suppurative peritonitis; (c) extreme paralytic ileus accompanying typhoid fever; (d) injuries to, and diseased conditions of, the spinal column producing a paralyzed condition of the intestines.

100 State Street.

THE POLLUTION OF STREAMS BY DISTILLERY WASTE

WITH SPECIAL REFERENCE TO LEPTOMITUS LACTEUS *

MARSHALL LANGTON PRICE, M.D.
AND
WILLIAM ROYAL STOKES, M.D.
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The pollution of streams by distillery waste is, in the United States, a comparatively recent problem. Changes in the condition of the liquor trade have brought about the concentration of distilleries around cities and thickly settled communities, where they give rise to nuisances, the character and severity of which are governed mainly by the process employed and by the size of the stream into which the waste is emptied. The pollution of water courses in one way or another is certainly one of the most serious and important problems with which the health authorities have to deal. This is probably the only sanitary problem in which public opinion and the law have kept pace with scientific progress. The riparian rights of owners have been jealously guarded by the common law for several centuries and have been affirmed by statutes in many of the states of the Union.

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* Prepared for, but not read before, the Section on Hygiene and Sanitary Science of the American Medical Association, Chicago, June, 1908.

THE LEGAL ASPECT

The common law proposes that the owner of riparian rights shall have guaranteed to him not only the quantity of water which is necessary for his purposes, but also that its quality shall be unaffected, or, as the law has affirmed on several occasions, "the right of a riparian owner to have the water of a stream come to him in the natural purity or in the condition in which he has been using it for purposes of his domestic use or of his business is as well recognized as is his right to have the flow to his land in its usual quantity."[1]

An abstract from the opinion of Judge Magruder of the decision of the Court of Appeals of Maryland in the case of Wm. E. Woodyear vs. Henry Shaefer, April term, 1881, is worthy of quoting, as it specifically demolishes all of the ground on which the pollution of a stream is generally maintained. The following points are especially important: "There can be no prescription for a public nuisance." "Where any prescriptive right to pollute a stream has been gained it can only be maintained to the extent that it is shown to have injuriously affected the interest complaining." "It is no answer to a complaint of nuisance that a great many others are committing similar acts of nuisance on the stream; each and every one is liable to a special action and to be restrained." While this decision in the case of Woodyear vs. Schaefer holds the specific nuisance at issue, namely, a slaughter house, to be *prima facie* a nuisance, and it is held that blood running into a stream constitutes a nuisance that will be restrained, it is not held, so far as I know, in any court, that distillery waste is *prima facie* a nuisance, and it is necessary to show in any specific case that such waste does cause a nuisance.

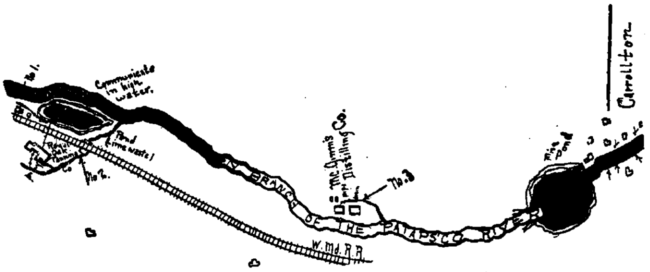

Fig. 1.—Sketch map of the North Branch of the Patapsco River (not drawn to scale), showing the R. Tannery, the M. Distillery and the town of Carrollton. The arrows and numbers indicate where specimens were taken.

The decisions quoted refer mainly to suits in equity or to injunction proceedings to restrain a nuisance. Evidently this is not sufficient, however, in the pollution of streams where so much serious damage to health, comfort or property may exist, and the laws of Maryland make the pollution of streams a misdemeanor, punishable by fine or imprisonment, and similar statutes exist in other states. These statutes do not specifically refer, however, in general, to distillery waste. Hence in the specific case which we describe it was necessary to show, first, that the stream in question was polluted and rendered unfit for drinking or domestic purposes; second, that the distillery waste in question was the cause of such pollution either in whole or in part. With this review of the general legal principles involved in the pollution of a stream, we may pass to this specific case, which is of particular interest on account of the fungus growth causing the pollution and of its direct dependence on the distillery waste.

POLLUTION OF THE PATAPSCO RIVER

During May, 1907, the secretary of the State Board of Health of Maryland, one of the authors of this paper, received a petition from 124 residents of some two or three small towns along the bank of the Patapsco River of Maryland to restrain the M. Distilling Company and the R. Tanning Company (Fig. 1) from discharging their waste into the stream, alleging that a serious nuisance was being produced by these two corporations. An inspection of this stream was made about the 1st of May with the county health officer, beginning with the tannery and following the stream down about three miles through two or three small villages. The water beginning about one-half mile below the tannery became black from the lime and tan bark discharged from the tannery and continued so for a distance of two or three miles. At the site of the distillery a frothy white liquid ran into the stream without producing any perceptible change. About a quarter of a mile below this point, however, there was a very perceptible odor, which increased in intensity as we descended the stream. At a pond furnishing power for a flour mill a number of dead fish were seen on the surface, and at a small town, below, the fungus which we describe appeared in great quantity along the bottom and sides of the river and at the race leading into the flour mill.

The odor along the banks of the stream was perceptible for several hundred feet back and was almost intolerable at the flour mill. The fungus accumulated at this place and had to be removed with a rake or shovel, and there must have been 100 pounds removed daily. In the stream the fungus could be seen adhering to the banks or growing from sticks like sponges. The free filaments gave a beautiful feathery appearance to the growth when floating in the water. The specimens when removed collapsed in a gelatinous mass and gave forth the most remarkably putrid, acrid and nauseous odor which we have ever experienced. The specimens were taken from this point and sent to the bacteriologic laboratory for examination. An opinion was delivered on this nuisance to the county health officer on May 6, 1907. The following are the main points as regards the M. Distilling Company:

First, that the said firm or corporation is situated on the Patapsco River near Carrollton, and that it is engaged in the manufacture of rye whisky.

Second, that the firm, in the manufacture of rye whisky, causes a mash of rye and water with yeast or some other ferment to ferment in large tanks or vats to produce alcohol and other extractives, giving the whisky its essential flavor and properties.

Third, that the firm causes its mash when fermented to be distilled at a low temperature to produce whisky.

Fourth, that the firm causes the residuum of the mash remaining after distillation to discharge through an open drain into the waters of the north branch of the Patapsco river at a distance of about 100 yards.

Fifth, that the waste material discharged from the drain of the firm has a sour, penetrating and disagreeable odor.

Sixth, that the waters of the north branch of the Patapsco river have, at Carrollton, at some distance above and below, a sour penetrating and disagreeable odor.

Seventh, that the M. Distilling Company has violated the provisions of Section 429 of Article 27 by permitting

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[1] Wood on Law of Nuisance, Sec. 677: Gladfelter vs. Walker, 40 Md. 1, Wood vs. Suttcliffe, 2 Sim N. S. 163; 8 Eng. Law and Equity 217: Stockfort Water Works Co. vs. Potter 7, H. and N. 159.

> offensive matters to flow from the distillery of the said company into the north branch of the Patapsco river, thereby causing pollution of the stream.

The following extracts are taken from the general opinion in regard to the nuisance:

> That the waters of the Patapsco river have continuously, or at intervals, an offensive odor from a point a short distance below the plant of the M. Distilling Company to and below the town of Carrollton.
>
> That the waters of the Patapsco River contain between the points specified in Section 2, a growth of the nature of algæ of penetrating and offensive odor.
>
> That the waters of the Patapsco river have been habitually used for domestic purposes until they became fouled and polluted and unfit for domestic use.

Representatives of the corporation and petitioners were heard before the State Board of Health on June 12, and on June 13 orders were issued to the M. Distilling Company, through the president and general manager, enjoining them and all other officers, agents, employés or stockholders of the body corporate against causing, allowing or permitting any of the waste from their distillery to flow, directly or indirectly, into the Patapsco River after June 23, 1907. The distilling company shut down about June 20, a few days before the order went into effect.

On July 5 we visited the distillery to determine whether the orders of the board had been complied with and also to investigate the condition of the stream since the polluting materials had been withdrawn. We inspected the stream for about two miles and took frequent scrapings from the bottom with a long rake. We found this particular fungus had completely disappeared in the short interval since the shutting down of the distillery plant. We found a few fungi of the common variety, mostly chlorophyl-bearing algæ, without unpleasant odor excepting a slight fishy smell. Some of the peculiar characteristic odor remained in the deep scrapings from the bottom. The disappearance of algæ was so complete that we were unable to obtain any specimens for examination. The citizens along the bank reported the stream free from odor.

NATURE OF THE WASTE

Distillery waste is a yellowish-white, opaque liquid with a spirituous or yeasty odor and slightly acid reaction, due to acetic acid. In about twenty-four hours the reaction becomes alkaline. As appears in the analysis, it contains a very large quantity of nitrogen and

ANALYSIS OF SAMPLE MARKED "X———— DISTILLING COMPANY."

(All figures expressed in parts per million.)

Color	Yellow
Odor	Spirituous
Total solids	17,990
Ignited or mineral solids	1.896
Volatile and organic solids	16,094
Chlorin	20.5
Nitrogen as free ammonia	8.33
Nitrogen as albuminoid ammonia	18.76

shows that the organic matter has only partially been exhausted by fermentation. The chemical analysis does not show why this material should be so favorable to fungus growth and particularly to the *Leptomitus lacteus*. Apparently the conditions under which this fungus grows are more or less delicately balanced. Too great or too little a dilution will apparently prevent its growth. In this particular instance the fungus did not appear until the stream had flowed about one-quarter of a mile beyond the distillery outlet. Since the dilution progressively increases in any stream, we would expect to see the fungus appear in small streams in some part of their course, but, on the other hand, if the waste was discharged at once into a large body of water the dilution would probably be too great to favor the growth of the *Leptomitus*. In a small stream such as this the only means that could be suggested would be to completely dry and dispose of the waste or by aseptic tank process carry the fermentation process to a complete stage of decomposition. Attempts to cultivate the fungus have been uniformly unsuccessful, though during June we attained partial success by some experiments carried on at room temperature. Evidently it was necessary in this instance to obtain corroborative evidence that the growth of the *Leptomitus* was dependent on the distillery waste and not on the discharge from the tannery or a mixture of the two wastes. Experiments were made with two samples of tannery waste, Specimen 1 and Specimen 2, and with distillery waste, Specimen 3. Dilutions were made in ordinary fruit jars as follows: Tannery Specimen 1, two samples, dilution 1 to 500 and 1 to 5,000; tannery Specimen 2, same dilutions; Distillery Specimen 3, two samples, same dilutions. We then had six jars containing two different kinds of waste, diluted in proportions of 1 to 500 and 1 to 5,000. Six additional samples were then prepared by mixing equal parts of the 1 to

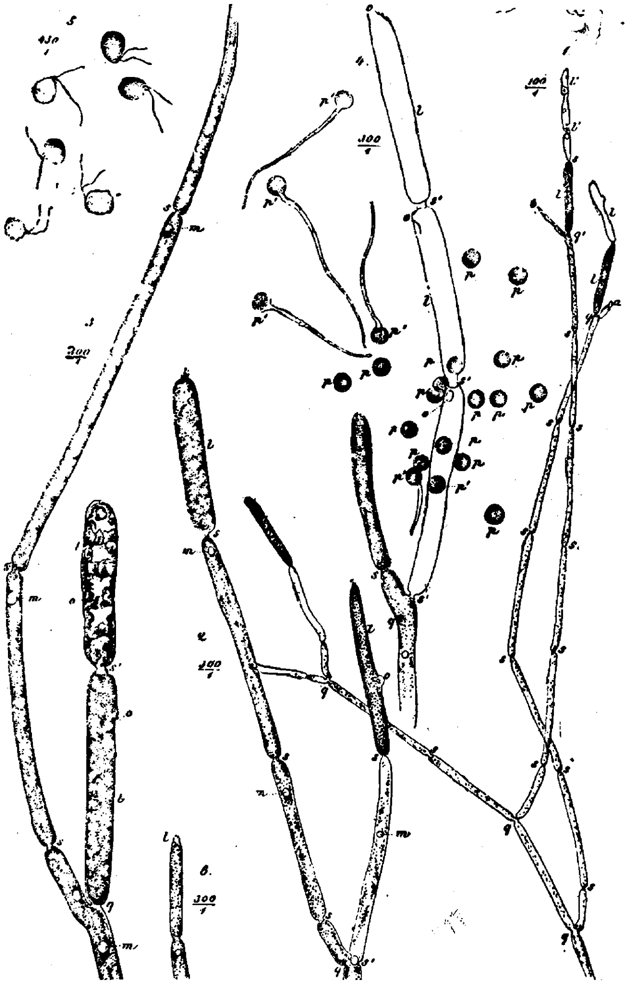

Fig. 2.—Photograph copied from *Jahrbüch. f. Wissenschaftliche Botanik*, vol. ii, 25, showing different conditions of *Saprolegniæ lacteæ*. m, nuclei at the joints; s, the constrictions; p, spore swarms at rest after evacuation from the Sporangium; p', young spores producing "Schlanchen" or hyphæ. At e' (1) a few spores are seen in the sporangium. At s' (4) the nuclei close the constrictions and form the partition walls of the joints.

500 distillery waste with tannery Specimen 1 and Specimen 2 separately and with equal parts of the mixture of Specimen 1 and Specimen 2, the samples being in 1 to 500 dilution, and a similar set of samples were prepared in 1 to 5,000 dilution.

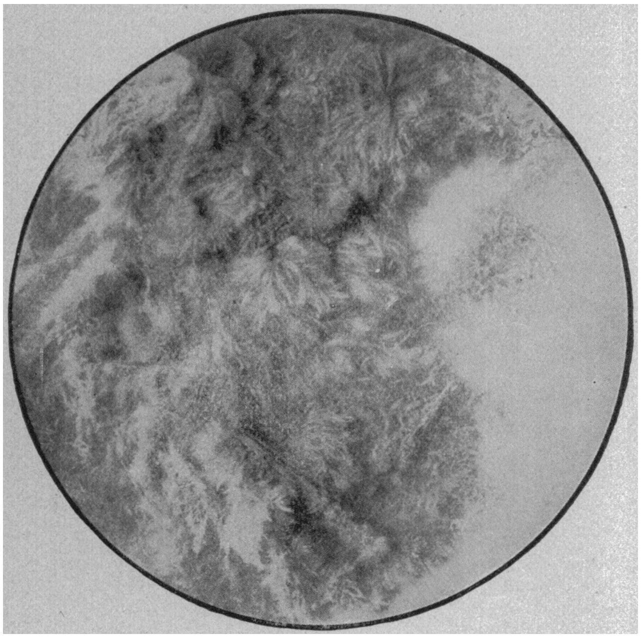

Fig. 3.—Photograph of gross specimen showing its shaggy, coarse, hair-like appearance.

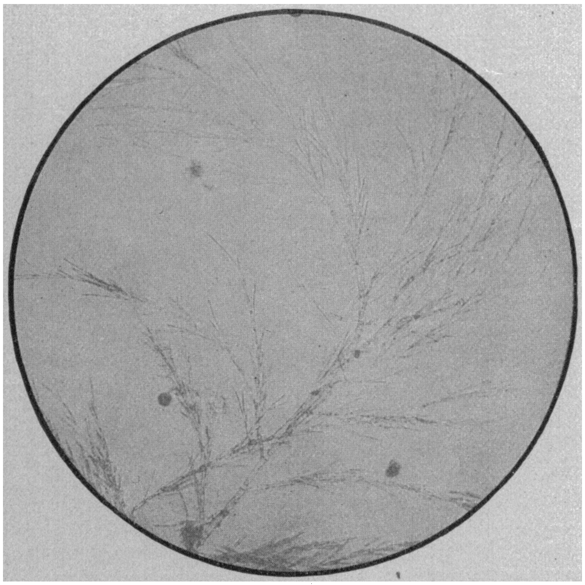

Fig. 4.—The fungus under a low magnification, and the central large stem containing numerous smaller branches is well demonstrated.

A portion of the fungus was removed by the point of a paper knife and washed off by movements of the knife in the fluid. The odor soon disappeared from the jars, excepting a slight leathery odor in those containing tannery waste. At the end of three days the characteristic odor reappeared in the inoculated jar containing the unmixed but diluted distillery waste. This was only plainly perceptible in the 1 to 5,000 dilution, and in this jar evidences of growth could be plainly perceived in new filaments springing off from the original material. None of the other samples containing tannery waste alone or mixed with distillery waste showed any evidences of growth.

It appears, therefore, from this partially successful experiment that a high dilution is necessary and that the products of the tannery inhibited the fungus. It remains to explain the universal disappearance of the *Leptomitus* when cultivated *in vitro*. Either the fungus exhausts its own nutriment and in a very short time ceases to grow or else, which seems more probable, some of the products of growth are toxic to the fungus, and its reproduction ceases on account of a species of autointoxication. We believe that both of these conditions can be met successfully, and if we are able to secure any more of the fungus we propose to treat it by continuous irrigation with diluted distillery waste, allowing the material constantly to siphon into the jar and overflow. In this way we could reproduce very closely artificially the conditions in which the fungus is found in the streams. One of the interesting phases of the joint association of this fungus and distillery waste in streams is the destruction of fish. This generally appears to kill only a certain proportion of fish and not to destroy all of those in the stream. While we have obtained dead fish and subjected them to autopsy, we have been unable to determine the cause of their death. Whether it is due to poisonous products of the fungus or its growth within or on some part of the fish, we have been unable to ascertain, but that it is due to the distillery waste in this instance can scarcely be doubted, as experiments *in vitro* with the tannery waste on living fish have been without result.

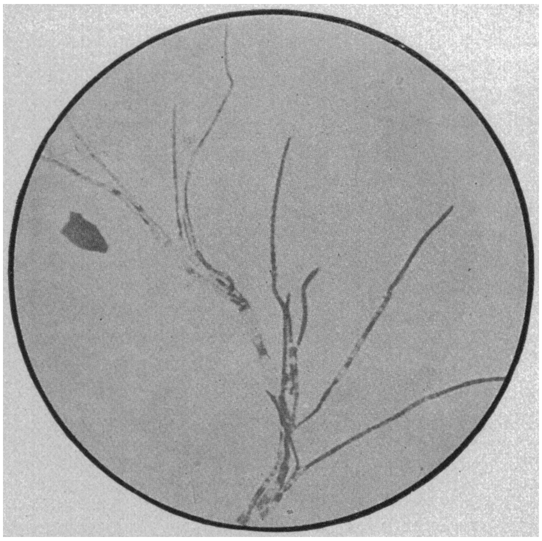

Fig. 5.—This shows a specimen dried and stained by hematoxylin. The dichotomous branching from the parent stem is clearly seen.

THE SAPROLEGNIÆ

According to Pringsheim[2] the *Saprolegniæ* form a subdivision of the *Algæ*. They are often found in water attached to animal or vegetable materials forming growths radiating from all sides of their host, their straight or branched hyphæ often penetrating deeply into the material, such as a stick or stone. Their protoplasm does not contain any chlorophyl or starch. Pringsheim thinks that they belong to the *Algæ* since they form spore-swarms, and no true moulds do this, and the formation of generative cells and the alternating sexual and asexual generation places them in near relationship to the *Vaucheriæ* and *Confervæ*.

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[2] Jahrbücher für wissenschaftliche Botanik, Berlin, 1858,, i, 284.

As mentioned above the *Saprolegniæ* have a double cycle of development; a sexual and an asexual generation. The asexual growth begins by one of the hyphæ cutting itself off from the main stem by transverse fission and forming the so-called mother cell of the swarm of spores. The protoplasm divides into a large number of spores, which soon escape from the sporangium. Another hypha grows from the emptied spore-sac, and so the growth progresses. The spores are motile and have cilia which propel them through the water.

The most important part of the sexual apparatus of the *Saprolegniæ* consists in the female sexual organ, or the oögonium, which forms the oöspores. These oögonia are developed from special branches which grow from the sides of the main hyphæ, and are later cut off and form the female organ. Certain clear spots appear in the protoplasm and the wall later is absorbed at these points and these orifices admit the spermatozoa.

Coincident with the changes just described a gradual separation of the contents of the oögonium takes place, which results in the formation of a number of masses of protoplasm which form the ova ready for fertilization. The protoplasm forms itself into globular shapes which form the daughter cells of the structure. In some of the forms of *Saprolegniæ* branches grow out from the stalk of the oögonium, which grow around and even cling to the outside of the female sexual organ. These branches are called antheridia, and they penetrate the perforations in the wall of the oögonium and probably fertilize the immature ova by means of spermatozoa. These spermatozoa are embedded in the antheridia, surrounded by a mucoid material; after they have entered the protoplasm of the female element they appear as fine refractive bodies which soon mix with the substance of the protoplasm of the female element. Following this act the oöspores are formed which are the lasting seeds of this species.

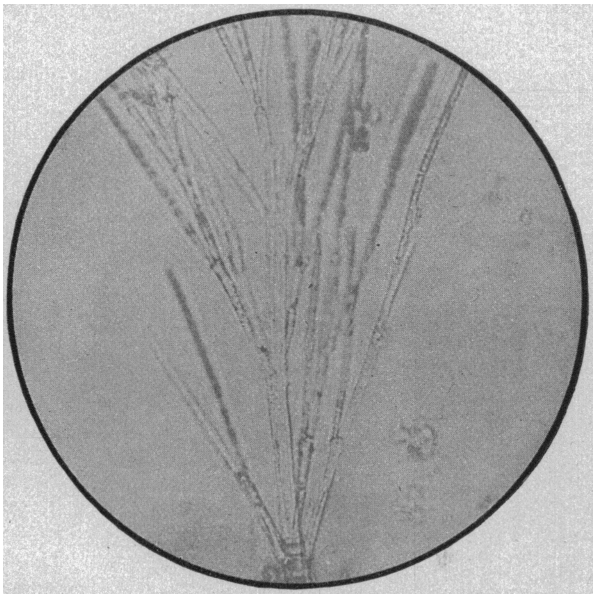

Fig. 6.—This shows the branching end filaments when photographed from a fresh specimen.

In some species of *Saprolegniæ* such as *Saprolegnia ferox,* these antheridia are not formed, and the spermatozoa are derived from egg-shaped cells which form at the end of hyphæ. A large number of small motile branches which rupture the mother cell become free later in the surrounding medium. They have cilia and are spermatozoa derived from these special antheridia. In summing up the characteristics of the *Saprolegniæ* the following résumé is given by Pringsheim:

"The *Saprolegniæ* are cryptogamic, colorless, parasitic water plants belonging to the division of the *Algæ.* The vegetative parts are formed from a single many-branched mycelium. Many spore-swarms form at the ends of the cut-off hyphæ, which spores have one or two cilia. Oögonia are formed from the thickened ends of short side branches which contain many openings. Antheridia are single-celled, and are formed by side branches from the stem of the oögonium. These antheridia contain many small rod-like spermatozoa. Oöspores are formed which later grow to hyphæ or form spore-swarms."

LEPTOMITUS LACTEUS

The organism which infected the stream is one of the *Saprolegniæ,* and belongs to the genus *Leptomitus.* Dr. Karl F. Kellerman, physiologist in charge in the Bureau of Plant Industry, U. S. Department of Agriculture, to whom we are indebted for a diagnosis, thinks that it is probably the *Leptomitus lacteus,* and a brief description of this organism is therefore in order.

The *Leptomitus lacteus* was first described by Agardh[3] in 1860, and later by Pringsheim[4] more thoroughly. According to this author this plant only occurs in the flowing water of small or large streams, occurring in winter as well as in summer. It forms either small or large masses of a dirty white material often spread over extensive areas. The filaments are often several inches long, and often cover the surface of the water, as well as every root or branch of a tree or large stone in the water. They form long, floating, slimy masses resembling wool spread over these various surfaces.

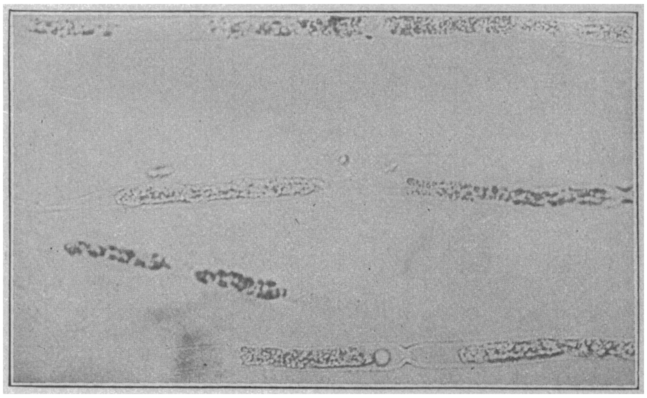

Fig. 7.—Two groups of three spores each, showing the granular protoplasm of the spores.

Under the microscope the plant shows dichotomous branching with slight constrictions which resemble joints. They are not true joints, however, and the entire plant is continuous and unicellular. Either one or several nuclei are often found near these constrictions. In young hyphæ the nucleus is homogeneous, but in old ones it may show several concentric layers. New branches are formed by the growth from the point or end of a branch or by side branches. These younger branches are smaller than the parent branch at first.

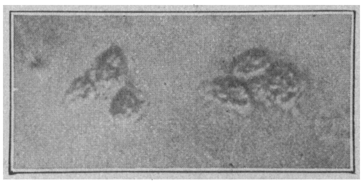

Fig. 8.—This shows the individual hyphæ under the high power. The constriction with the nucleus adjacent is quite apparent, and the granular protoplasm alternating with the clear hyaline contents of the filament is clearly indicated.

The formation of sporangia is accomplished by a swelling of one of the end hyphæ, its protoplasm increases, and by transverse fission it cuts itself off and forms a complete single cell. This soon forms a sporangium in which the protoplasm begins to heap up in a manner similar to that described above in the other *Saprolegniæ.* This process ends in the formation of motile bodies which form swarms of spores. These spores measure 1/86 of a millimeter in diameter and have two cilia, and hyphæ soon grow from these spores and thus continue the species.

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[3] Syst. Alg., p. 50, Kützing, Species Alg. p. 155, Dilhoyn's British Confervæ, 1809, Tab. 79.

[4] Jahrbücher für wissenschaftliche Botanik, Berlin, 1858, ii, 205.

The organism is very difficult to cultivate artificially, often dying out several hours after transplantation, but its life may be prolonged by adding insects to the water. Pringsheim could not observe the formation of sexual organs under these conditions. By supplying fresh water frequently he grew the plant for one week. He was never able to find oögonia or antheridia in this fungus. We obtained large quantities of the organism on two separate occasions from the stream, and on microscopic examination they both corresponded in all of their characteristics to *Leptomitus lacteus* as described by Pringsheim.

Figure 2 is a photograph of Table XXV from the *Jahrbüch. f. w. Botanik* showing the excellent drawings of the fungus by Pringsheim. The description at the bottom of the figure describes the plate in detail. The granular protoplasm of the hyphæ is well shown, and the nodes or constrictions are also seen at fairly regular intervals. The round, clear nuclei are usually placed near these constrictions, and the drawing also shows the true dichotomous branching of the mycelium. The spores singly, or in swarms, are clearly depicted, and the beginning of new hyphæ can be seen originating from the single spores. A few of these spores also show cilia, and Pringsheim described active motility of these spores. Figure 3 shows a photograph of the gross specimen as it appears when taken from the stream. The shaggy, coarse appearance of the threads resembles a bushy mass of hair. The specimen when fresh had a most penetrating, offensive odor, and this is still present after having remained about a year in formaldehyd solution.

Figure 4 is a photomicrograph of the fungus under the low power. A long central stem is seen from which smaller branches grow. These again branch into many terminal filaments. Figure 5 is a photomicrograph of a stained specimen. The fungus was simply dried on a slide and stained by hematoxylin and it shows dichotomous branchings of the end branches, and also contains large clear areas without any granular protoplasm. Figure 6 shows the many branching end filaments when photographed from a fresh specimen. Some of these end hyphæ are said to separate from the rest by transverse fission, and form sporangia. The spores form in these sporangia, and later free themselves and become spore-swarms. Figure 7 shows two groups of three spores each. They are rather oval in shape, and contain coarsely granular protoplasm. Figure 8 shows individual hyphæ under the high power. Granular protoplasm alternates with clear areas, and the clear nucleus of one of the hyphæ appears adjacent to one of the constrictions.

From what has gone before we have concluded that the fungus corresponds in its properties with that described as *Leptomitus lacteus* by Pringsheim.

Clinical Notes

A NEW METHOD OF TAKING *X*-RAY PICTURES

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The object of this paper is to demonstrate what I believe to be an entirely new method of taking *x*-ray pictures, the result of this process being to overcome the density. In this new method, as the illustrations show, two tubes or even three are used in the apparatus at the same time, one tube being placed above the subject in the usual manner, while the other tube or tubes, which we will call auxiliaries, are placed at a different angle. An attachment is placed at the side of the subject, which for want of a better name I call a "cut off" or secondary diaphragm, which is placed one-half way or less, on one or both sides of the trunk or head, either posteriorly or anteroposteriorly, and the tube or tubes are so placed that the anode is exactly centered in the middle of the diaphragm, so that when the side tube or tubes are excited they will penetrate or throw rays laterally. Thus the auxiliary tube or tubes strike the subject midway of the trunk or head, by which means that portion is penetrated by the auxiliary tubes and offers less resistance to the tube placed above in the usual manner, the latter penetrating the part nearest the sensitized plate.

It is better to use a compression diaphragm or other apparatus, and especially a tube box that will condense the rays of all the tubes, so that the so-called S rays are cut off.

In this method a good many disappointments will accrue in the preliminary trials. It will be necessary to use two exciting apparatus, as I find it impossible to excite two tubes satisfactorily with

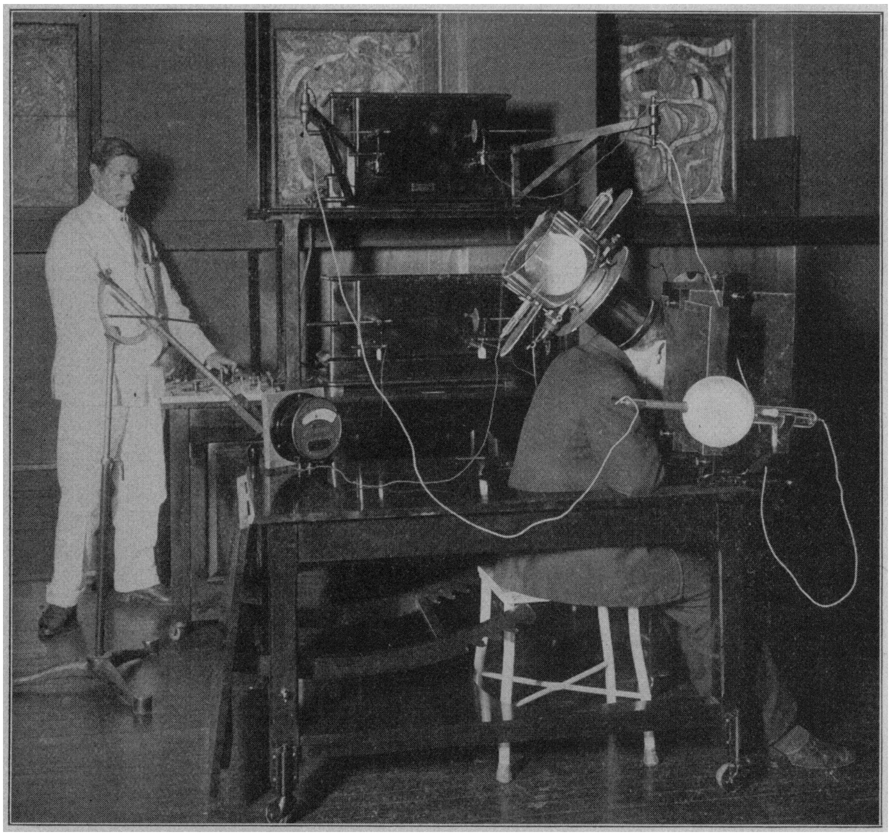

Fig. 1.—A new apparatus for reducing density, showing the working parts: the tube above takes the picture while the rays from the tube on the side passing through the subject in an oblique manner, allow the rays from the upper tube to pass more readily, thus giving greater intensity. **An antero-posterior skiagraph of the head is being taken.**